

**Supersedes:** None

**ISO/WD 10303 – 226**

**Standard title:** Industrial automation systems and integration -

**Series title:** Product data representation and exchange -

**Part title:** Part 226: Application Protocol: Ship Mechanical Systems

## **AP226 PLIB-related Issue Log**

### **ABSTRACT:**

ISO 10303 Part 226 that deals with ship mechanical systems data representation for the purpose of electronic data interchange. Ships mechanical systems, within the scope of this standard, include ship's propulsion systems, auxiliary systems and deck machinery systems, together with their components. Product data pertaining to all lifecycle phases of ship mechanical systems are in the scope of this standard. The lifecycle phases covered include specification, selection, installation, commissioning, operation, in-service inspection, maintenance and decommissioning.

This document represents the issues raised during AP226 developments, while investigating ways of making AP226 and Patrs Library 13584 standards interoperable. The objective of the investigation was to use 13584 standards capability in developing dictionaries of classes and properties to enhance the generic aspects of AP226 and separate the dictionaries of mechanical products and their properties from the way they are going to be used.

### **COMMENTS TO READER:**

This document is in draft format and is intended for discussion in the joint meetings of SC4's WG3/T23/AP226 and WG2.

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# AP226 PLIB-related Issue Log

**ISSUE: CTC-AP226PLib-1**

AUTHOR: Gopal Salvady

CLAUSE: -

CLASSIFICATION: MINOR/TECHNICAL

DESCRIPTION: Should AP226 property value be in PLib or in AP226?

**PROPOSED SOLUTION:**

Guy: Some property values that identify the set of allowed values for this property should be in the PLib. For instance, a range is defined by its low-bound and high-bound that should be specified in the PLib. But it shall not contain the value for a particular AP226 mechanical object.

The discussion following this issue were as follows:

The AP226 PLib Dictionary shall contain

Classes (similar, in EXPRESS, to entity data types) while AP226 shall contain occurrences (similar, in EXPRESS, to entity instances). Therefore, the property values for occurrences shall be in AP 226 (no duplication). AP226 PLib classes shall be in the normative annex in AP 226. Some of the questions that need to be answered are

1. Do we want duplication in AP 226 and PLib? (Guy Answer: No)
2. Should classes also be in AP 226? (Guy Answer: No)

**RESOLUTION:**

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**ISSUE: CTC-AP226PLib-2**

AUTHOR: Gopal Salvady

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: Array data types are missing in PLib?

**PROPOSED SOLUTION:**

The Part Library information model is defined in existing EXPRESS schema and currently we cannot put new structure of objects in the library (e. g. aggregate): only classes.

Use one of the following options:

- a - Cut in to pieces the array variable as individual attribute or
- b - use entity\_instance datatype (cf P-Lib Part 42) or
- c - use concept of feature (cf P-Lib Part 24)

Recommendation : either (a) or ( c)

**RESOLUTION:**

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**ISSUE: CTC-AP226PLib-3**

AUTHOR: Gopal Salvady

CLAUSE: -

CLASSIFICATION: MINOR/TECHNICAL

DESCRIPTION: How to represent centre of gravity using Cartesian co-ordinate?

**PROPOSED SOLUTION:**

Center of gravity of a mechanical product is a point represented in Cartesian co-ordinate. Point can be

represented as an array of real integer type. But array is not supported by PLib. So, one of the following two options can be followed to represent centre of gravity.

1. 1. Consider each component of co-ordinate (centre of gravity) as property of the class. For example, property Cg-X shall be the X-coordinate of center of gravity, Cg-Y shall be Y-Coordinate and Cg-Z shall be Z coordinate of the centre of gravity.
2. Use feature as proposed in CTC-AP226 PLib 2.

Note 1: Don't overuse feature.

Note 2: But Feature option is not implemented in the current version of Coolstaple software that is used in developing the AP226 PLib Dictionary.

RESOLUTION:

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**ISSUE: CTC-AP226PLib-4**

AUTHOR: Gopal Salvady

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: Difference between instances and occurrences and how to deal with them needs to be clarified.

PROPOSED SOLUTION:

The instance/occurrence concepts acknowledge the fact that:

- A class describes (in general) different "things" with different property values (e.g., dimensions); these different "things" are different "instances" : a particular instance is completely defined by a set of property value (e.g., a 10 x 5 M hex.screw), it is an abstraction and not a real object in a real product,
- several "material" objects, corresponding to the same set of property values may be used in the same product (e.g., a ship may contain 12537 screws whose characteristics are "10 x 5 M hex screw") ; each of these "material" objects are "occurrences". They share a set of common properties (length = 10, diameter = 5, ...). They differ from each other by occurrence properties, mainly: location, part number, date\_placed\_in\_service, date\_of\_manufacture,...
- Occurrence properties should be defined by AP226 information model, and not by PLib Dictionary (Guy Pierra suggests to have "date\_placed\_in\_service" defined in AP 226 core model than in its PLib-compliant Dictionary)
- Instance properties should be defined by PLib dictionary (e.g., the function, inertia, power\_maximum, ...)
- property values of both kinds for one particular product/part belonging to AP226 data shall be stored in AP 226 data.
- AP 226 may, in AP 226 data, either :
  - represent both concepts of "instance" and "occurrence" : all the common properties are represented only once, (at the instance level) and each occurrence refers to an instance and contains its own occurrence properties, or
  - represent only one concept, that would be occurrence ; in this case each occurrence would contain both instance properties (e.g., screw diameter) and occurrence properties (e.g., part number, location,...).

RESOLUTION:

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**ISSUE: CTC-AP226PLib-5**

AUTHOR: Gopal Salvady

CLAUSE: -

CLASSIFICATION: MAJOR/EDITORIAL

DESCRIPTION: Include instance in reference library?

PROPOSED SOLUTION:

There shall be no instances in the reference library, only classes.

RESOLUTION:

Agreed.

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**ISSUE: CTC-AP226PLib-6**

AUTHOR: Gopal Salvady

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: How to model Express constraints such as (optional WHERE rule etc.) in PLib?

PROPOSED SOLUTION:

Submit SEDs report against Part 42 or comments against Part 24 (both are possible) about the domain restrictions. Currently, it is not possible to capture constraints and assertions in a dictionary (like AP 226 PLib compliant dictionary) but only in a library.  
(a "catalogue")

Note that all the material is already available in Part 24 (ISO 13584\_domain\_ressource\_schema). Thus it is only a management problem, not a technical problem.

RESOLUTION:

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**ISSUE: CTC-AP226PLib-7**

AUTHOR: Gopal Salvady

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: Mechanical\_product\_types:- should they be subtypes or attributes?

PROPOSED SOLUTION:

In AP226, for flexibility reasons, enumerated types are created at lower level. Also at lower level, there are attributes that define the type of object class. It is proposed that all types of mechanical products be represented as subtypes up to leaf level so that there can be no confusion for mapping classes between PLib and AP226. Also according to IEC 61360, these are considered the discriminating attributes. So, attribute also shall be retained similar to IEC in the AP226 PLib. But make sure that the Library consistently follows that a discriminating attribute with enumerated types are also subtyped.

*(Guy: I don't fully understand the last sentence.)*

RESOLUTION:

Agreed to proposed solution.

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**ISSUE: CTC-AP226PLib-8**

AUTHOR: Gopal Salvady

CLAUSE: -

CLASSIFICATION: MAJOR/EDITORIAL

DESCRIPTION: ARM level interface between AP 226 and PLib? How should be achieved.

PROPOSED SOLUTION:

- Harmonise with ship common model. Combine Zabi's and CTC's ARM.

-Consider the four "services" defined in "interpretation of PLib-Services" G. Staub (available on SOLIS as [http://www.nist.gov/sc4/wg\\_qc/qcn068/qcn068.pdf](http://www.nist.gov/sc4/wg_qc/qcn068/qcn068.pdf)). In the first part of the paper, services are defined at the ARM level.

RESOLUTION:

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**ISSUE: LR-AP226PLib-1**

AUTHOR: Zabi Bazari

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: Grouped properties (e.g. complex properties) are apparently not supported in PLib. However, for data exchange these grouped properties are important. How PLib is going to represent them.

PROPOSED SOLUTION:

Use feature class on case by case basis;

Note: Feature is not implemented yet in the current version of Coolstaple  
(*feature seems to be implemented in the new version of Coolstaple*).

RESOLUTION: Grouped property can be represented in AP226 itself. The project team can define them according to industry requirements and document them either as part of AP226 or as part of an implementation agreement between users of AP226 after approval of AP226. This decision was endorsed in WG2/AP226 Lillehammer meeting.

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**ISSUE: LR-AP226PLib-2**

AUTHOR: Zabi Bazari

CLAUSE: -

CLASSIFICATION: MAJOR/EDITORIAL

DESCRIPTION: AP documentation when AP226 combines with Parts Library. In view of proposed mixing of the STEP and Parts Library procedures, how AP documentation should be done.

PROPOSED SOLUTION:

- Create a Template to document the class, property and class tree using IEC 61360.
- Use IEC template/ use mail merge option to create the document. Clause 6 can use conformance application that must be supported in annex containing the AP226 PLib dictionary
- CTC shall investigate how maintenance entities which relate to class and property in library
- CTC to create mini-AP226 template for discussion in the next meeting.

RESOLUTION:

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**ISSUE: LR-AP226PLib-3**

AUTHOR: Zabi Bazari

CLAUSE: -  
CLASSIFICATION: MAJOR/EDITORIAL

DESCRIPTION: Tools to support?

**PROPOSED SOLUTION:**

Currently the AP developments are supported by STEP tools. Parts Library developments are supported by Coolstaple. Mixing STEP and PLib will require a mix of functionality currently available in both tools. How can this be achieved. CTC has proposed the following:

- Develop schema to check it against ProSTEP and STEPTOOLS when anything is changed in the AP.
- Dictionary in electronic format and in AP. Instance of dictionary in electronic format.
- No need to include dictionary in AIM schema.
- AP 226 pre and post processor should be included in the annex
- Dictionary is an integral part of the AP and it is just a document.

CTC would need to create a document (see **LR-AP226PLib-2**) and corresponding EXPRESS model to show how the above works.

**RESOLUTION:**

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**ISSUE: LR-AP226PLib-4**

AUTHOR: Zabi Bazari

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: How task and maintenance data are represented in PLib.

In a life-cycle view of product data, there is a need to associate maintenance data to products. It is not clear how this can be done in Part library.

PROPOSED SOLUTION: Parts Library standards do not deal with data during operational phase of product life-cycle. Therefore, AP226 would need to model these data outside the PLib.

RESOLUTION: PLib does not deal with these data. To be represented in the AP226 outside the PLib format.

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**ISSUE: LR-AP226PLib-5**

AUTHOR: Zabi Bazari

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: How occurrence data can be represented harmoniously with the instance data?

AP226, as a single standard, cannot adopt two methodologies for representing instance and occurrence level data. The documentation and modelling approach must be harmonious for the two sets of data. As PLib does not concern itself with the occurrence data, how this requirement can be met by AP226?

**PROPOSED SOLUTION:**

RESOLUTION: Product data, inclusive of instance or occurrence data, to be represented in a single PLib-compliant dictionary for AP226 [lillehammer meeting].

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**ISSUE: LR-AP226PLib-6**

AUTHOR: Zabi Bazari

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: Conformance to Ship Common Model

Within SCM, concepts of Item (things for which properties are defined) and Definition (grouped properties) are basic concepts that is used for:

1 – Support of Ship AP's interoperability and removal of overlaps;

2 – Support of various exchange scenarios in a flexible way;

AP226 must support the above structure to be interoperable with other ship APs. AP226, as a single standard, cannot adopt two methodologies for representing instance and occurrence level data. The documentation and modelling approach must be harmonious for the two sets of data. As PLib does not concern itself with the occurrence data, how this requirement can be met by AP226?

PROPOSED SOLUTION: Extend the property dictionary to include occurrence properties.

RESOLUTION: Include both instance and occurrence data in the AP226 dictionary (see also issue LR-AP226PLib-5) and Grouped\_property entities (see also LR-AP226PLib-1 and LR-AP226PLib-7) for this purpose.

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**ISSUE: LR-AP226PLib-7**

AUTHOR: Zabi Bazari

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: Conformance to Ship Common Model

Within SCM, concepts of Item (things for which properties are defined) and Definition (grouped properties) are basic concepts that is used for:

1 – Support of Ship AP's interoperability and removal of overlaps;

2 – Support of various exchange scenarios in a flexible way;

All the Items are expected to be included in the dictionary of objects. AP226 must support the concept of Definitions (Grouped\_properties) to satisfy the above requirement. In PLib, all the properties are allocated to the class of objects. AP226 would need to allocate properties to various complex data types entitled in generic term as Grouped\_property.

PROPOSED SOLUTION: Define AP226 Grouped\_property entities and allocate the properties from property dictionary to them.

RESOLUTION: Define Grouped\_property entities (see also LR-AP226PLib-1) and relate to class dictionary as is currently within AP226 in a generic way. Documentation of specific grouped properties could be done either in an AP226 annex or in an AP226 implementor's agreement.

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**ISSUE: LR-AP226PLib-8**

AUTHOR: Zabi Bazari

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: Conformance to Ship Common Model

Within SCM, concepts of Item (things for which properties are defined) and Definition (grouped properties) are basic concepts that is used for:

- 1 – Support of Ship AP's interoperability and removal of overlaps;
- 2 – Support of various exchange scenarios in a flexible way;

AP226 must support the above structure to be interoperable with other ship APs. The concept of Item in SCM refers to anything that needs to be defined and includes the following:

- Mechanical systems
- Structural parts
- Piping system
- Equipment, components, parts
- Activities and Tasks that is carried out on product.
- Anomalies such as faults and failures
- And so on

AP226, as an integrated standard, cannot adopt two methodologies for representing the above items. Classification of all items and their documentation as dictionaries are needed.

PROPOSED SOLUTION: Classify the non-Plib Items and document as a normative annex separate from the Plib dictionary. Alternatively, represent them explicitly in AP226.

RESOLUTION:

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**ISSUE: LR-AP226PLib-9**

AUTHOR: Zabi Bazari

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: Specialisation level in AP226 and transfer of Definition hierarchy from clause 4.2 to a normative annex.

Within the current version of AP226, the entities Definition Hierarchy have been specialised completely and explicitly. With change towards use of Plib dictionary, the specialisation needs to be removed and included in the library.

PROPOSED SOLUTION: Remove all the specialised Definition entities (e.g. Diesel\_engine\_general\_characteristics) from clause 4.2 and move to a normative annex with a Plib-style referencing mechanism.

RESOLUTION:

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**ISSUE: LR-AP226PLib-10**

AUTHOR: Zabi Bazari

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: Inclusion of AP226 properties in Annex M

All the properties of AP226 need to be defined and documented in the same manner and uniformly irrespective of being instance data or occurrence data.

PROPOSED SOLUTION: All AP226 properties to be documented in annex M in the same format.

RESOLUTION:



**ISSUE: LR-AP226PLib-11**

AUTHOR: Zabi Bazari

CLAUSE: -

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: Creation of AP226 long form and sample Part 21 file

The exercise by CTC should be continued with the creation of long form and a Part 21 file to show how practically the new approach will work and issues needs to be discussed and documented.

PROPOSED SOLUTION: CTC and LR to finalise this exercise.

RESOLUTION:

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**ISSUE: LR-AP226PLib-12**

AUTHOR: Zabi Bazari

CLAUSE: CTC report N00140-96-D-1818/0011, June 99

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: For all properties present in the Plib-dictionary, a UNIT must be specified (see ISO 13584-42). Additional allocation of UNIT to the property in AP226 MUST be avoided as it would create redundant definition and ambiguity. As such, measure\_with\_unit must be removed from Figure B-3 of the example on pipe-assembly (CTC report N00140-96-D-1818/0011, June 99) as is not needed.

PROPOSED SOLUTION: Remove measure\_with\_unit from AP226 or develop rules to avoid ambiguity. Alternatively, consolidate/integrate the dictionary schema (ISO 13584-42) with the AP226 schema (ISO10303-226).

RESOLUTION:

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**ISSUE: LR-AP226PLib-13**

AUTHOR: Zabi Bazari

CLAUSE: CTC report N00140-96-D-1818/0011, June 99

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: For all properties present in the Plib-dictionary, the type (string, real, integer, ...) is already defined in the dictionary. In this case, the value\_select in Figure B-1 CTC report N00140-96-D-1818/0011, June 99 must be compatible with the type as defined in the dictionary. How are we going to impose this rule?

PROPOSED SOLUTION: Consolidate/integrate the dictionary schema (ISO 13584-42) with the AP226 schema (ISO10303-226).

RESOLUTION:

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**ISSUE: LR-AP226PLib-14**

AUTHOR: Zabi Bazari

CLAUSE: CTC report N00140-96-D-1818/0011, June 99

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION: For all properties present in the Plib-dictionary, the classes to which they relate to are already in the dictionary (definition class). In Figure B-5 of CTC report N00140-96-D-1818/0011, June 99, Definition has a SET [0:?] properties and their values. At the same time Definition is defined\_for a Definable\_object and ultimately Mechanical\_product (see Figure B-7). The Mechanical\_product is a Plib\_class.

As such, we have referenced a class from TWO directions. First within property. Second from mechanical\_product. This cannot be right unless some rules be imposed to say that the two classes must be the same.

PROPOSED SOLUTION: Consolidate/integrate the dictionary schema (ISO 13584-42) with the AP226 schema (ISO10303-226).

RESOLUTION:

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**ISSUE: LR-AP226PLib-15**

AUTHOR: Zabi Bazari

CLAUSE: CTC report N00140-96-D-1818/0011, June 99

CLASSIFICATION: MAJOR/TECHNICAL

DESCRIPTION:

- 1 - So far, we have made the decision to represent all AP226 "mechanical products" as a PLib-dictionary.
- 2 - Within AP226, all types of "materials" (e.g. solid\_material, liquid\_material, coal, fuel\_oil and so on) have their own classification and properties.
- 3 - It seems that we should follow the same path as we did for "mechanical\_products" and create two dictionaries for "materials" and "material properties". These dictionaries will be documented in the same as "mechanical product" related dictionaries.

PROPOSED SOLUTION: Create dictionaries for "materials" and "material properties". These dictionaries will be documented in the same way as "mechanical product" related dictionaries.

RESOLUTION: Create a dictionary for "materials" and "material properties" in the same format as "mechanical product" and "mechanical properties". This was agreed by e-mail discussion during August and September 1999..

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**ISSUE: GP-AP226PLib-1**

AUTHOR: Guy Pierra

CLAUSE: -

CLASSIFICATION: MINOR/TECHNICAL

DESCRIPTION: Coding of classes and properties in "P\_Lib Data Dictionary Conforming to Step AP-226" document needs to be changed.

PROPOSED SOLUTION:

- Code string for class, property should be concatenated.
- At root level, declare super class of ICS (International class of standard)
- DO not use part code of ICS at lower level. You have to decide one tree or several. Use MPC.
- When you split class in to subclass, accommodate different viewpoint for the hierarchy. Allow user different mechanism for choosing hierarchy.
- Do not specify property in the root level. (or very few).

RESOLUTION:

Agreed the proposed solution.

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